SEPTA Projects of Significance Economic and Fiscal Impact

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ESI ECONSULT SOLUTIONS INC.
economics | policy | strategy

Study Purpose

- SEPTA's projects of significance change the development economics of the region
    - Increases in transit capacity and service quality enhance regional competitiveness and attractiveness
- This study quantifies the change in the level of expected regional activity over the long-term
    - Projection are developed for increases in employment, earnings and property value resulting from the investments
    - Analysis is long-term / catalytic in nature and excludes one-time benefits from construction & development activity
- This study quantifies the public return on investment of the projects
    - Accelerated growth in ongoing activity and property value yield increased tax revenues (state, city, suburban)
    - This analysis compares the cost of the projects to these government revenue returns in constant dollars to evaluate the ROI

SEPTA's Projects of Significance

Market Frankford Line Capacity

King of Prussia Extension

Regional Rail Enhancement

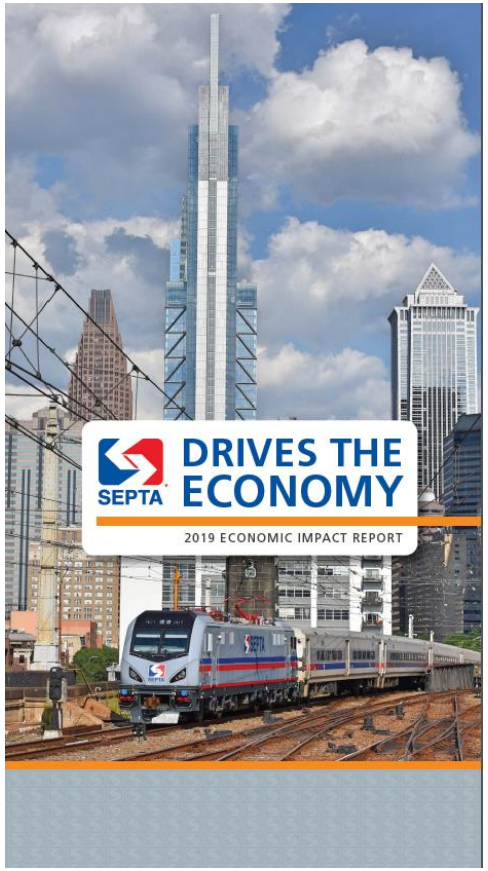
Trolley Modernization

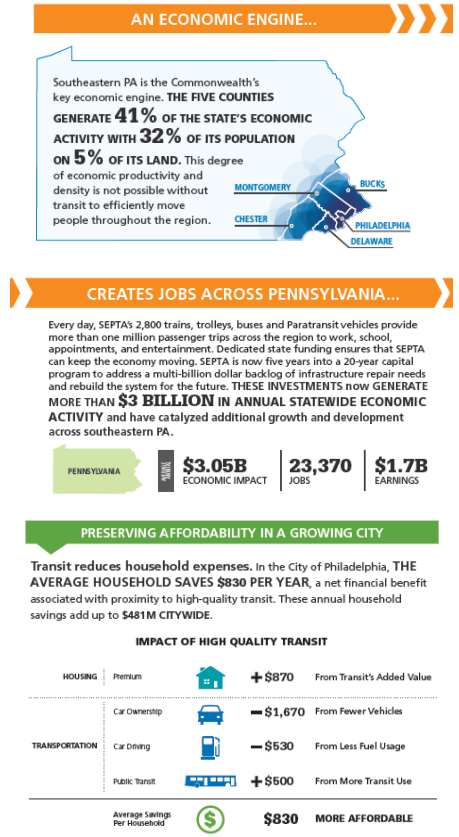
Economic Impacts of SEPTA

- Econsult Solutions, Inc. (ESI) has undertaken several recent studies to help SEPTA quantify economic impacts from its activity and service, evaluating:
  - Operating / Capital Expenditure Impacts
  - Suburban Property Value Impacts
  - City Property Value Impacts
  - City Affordability Impacts
  - Downtown Congestion Impacts
- ESI leveraged and expanded these existing models to estimate the catalytic impacts of SEPTA's planned projects of significance
- Fiscal impact analysis is utilized to translate these activity increases into a return on investment (ROI) framework

For more information on prior studies, visit septa.org/economic-impact

Economic Impacts from Transit





Projects of Significance - Overview

The projects of significance improve the regional transportation network in two distinct ways:

- **Capacity increases** grow the volume of riders delivered to the region's core employment nodes
- **Service quality** improvements benefit riders and in turn nearby housing values

Capacity Increases

Increased volume into downtown and KOP

Service Quality Improvements

Improved service through increased speed / frequency

Enhanced access to destinations with increased employment and amenities

Transportation Impacts by Project

	Capacity Change	Service Quality Change
MFL Capacity		
Increased number of cars	X	
Regional Rail Capacity		
Increased frequency	X	X
Increased speed		X
Increased capacity per car	X	
Trolley Modernization		
Increased speed	X	X
Increased capacity per car	X	
KOP Extension		
New destination served		X
Increased frequency	X	X
Increased capacity per car	X	

Flow of Economic and Fiscal Impacts

Transportation Improvements
Capacity
Speed/Frequency
More/Better Destinations

Localized Development Value
Downtown/UCity
King of Prussia
Along Transit Lines

Regional Attractiveness
Business Attraction
Property Value

Enhanced Economic Activity
Employment and Earnings
Business Sales and Profits
Property Value

Increased Tax Revenue
Pennsylvania
Philadelphia
Suburban

Development Impact

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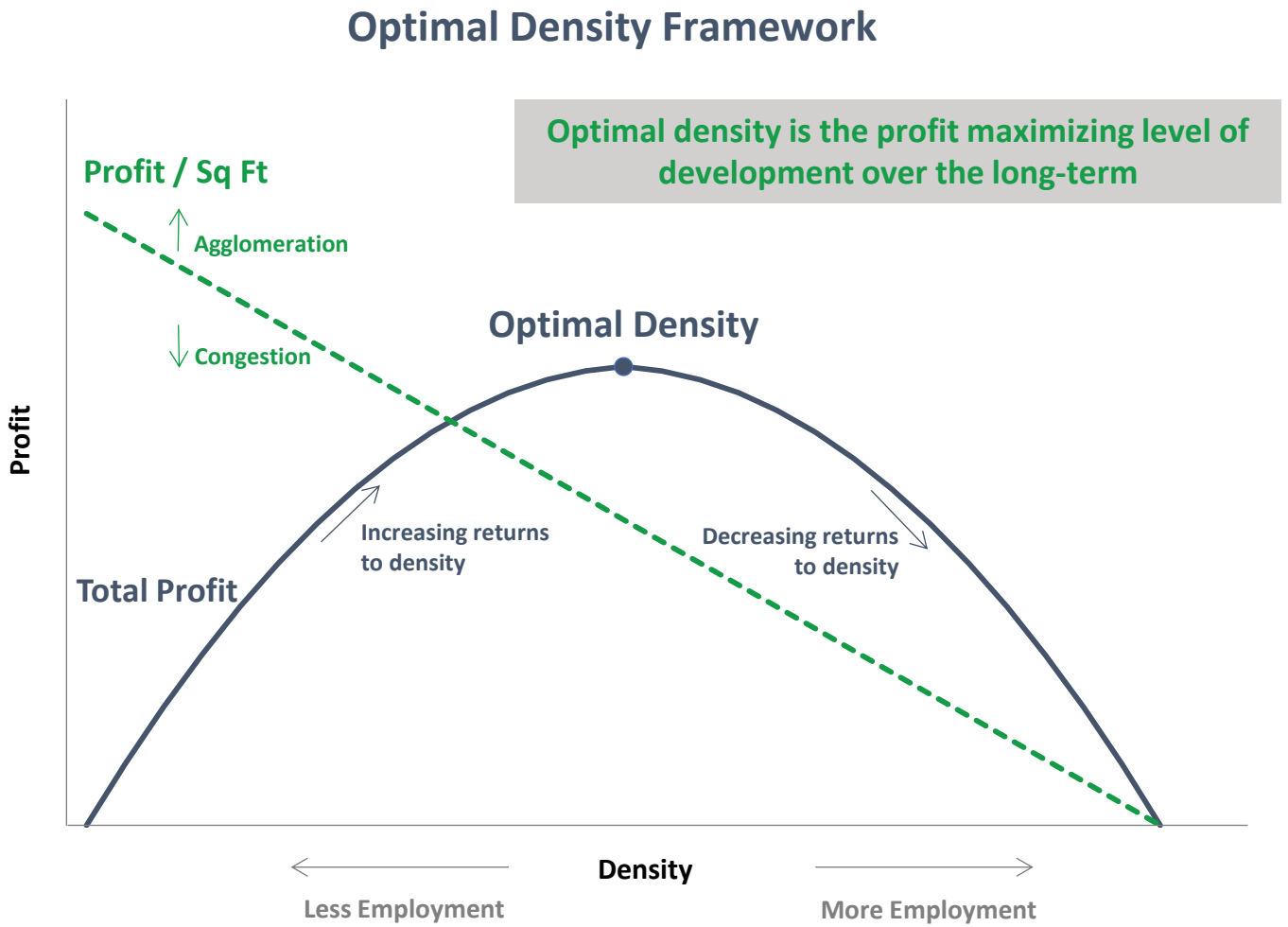
Optimal Density Framework

- Over the long run, development of a given parcel or area moves towards the expected profit maximizing height / density
- As average building size grows, total profit:
  - Increases due to more square footage
  - Increase due to higher productivity (from agglomeration)
  - Decreases due to increasing construction costs (per unit of height and in total)
  - Decreases due to growing congestion costs
- Total profit does not maximize where profit per square foot (or rent) is highest
  - Rather, the "optimal density" is the peak of total profit before decreases in profit per square foot outweigh additional benefits of additional square footage

This framework draws on the work of DiPasquale and Wheaton (1996)
Urban Economics and Real Estate Markets



Agglomeration Benefits with Employment Growth

- Agglomeration effects from increases in employment density are well-established
    - Productivity gains result from knowledge spillovers
- These gains are shared by labor (in the form of wages increase) and capital (which flow to land value)
- Productivity gains increase the attractiveness of locating a business in downtown Philadelphia as employment levels increase

Agglomeration Impacts per Downtown Office Worker

Estimates of magnitude of agglomeration impacts are drawn from: Graham (2018) *Quantifying Wider Economic Impacts of Agglomeration for Transport Appraisal: Existing Evidence and Future Directions*

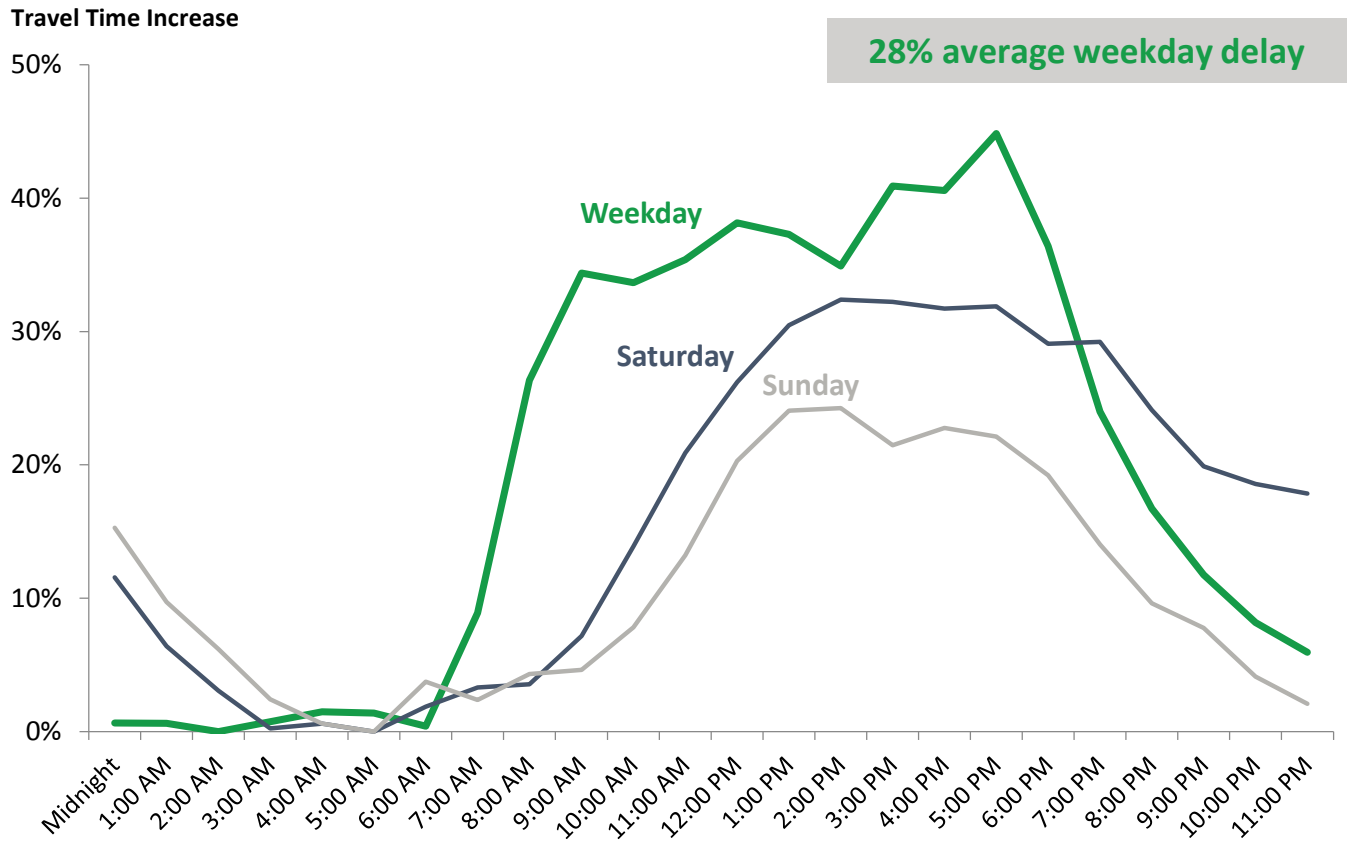
Throughout this report, "Downtown Philadelphia" refers to the office market encompassing Center City and University City. Current employment in this area is about 313,000, of which about 200,000 jobs are in the office sector.

Congestion Delays

- ESI previously undertook a detailed analysis of travel time losses on the downtown Philadelphia street grid
- Time losses for car passengers average 28% over the course of a weekday (relative to free flow speeds observed in the middle of the night)
    - 8 million hours of car passenger time lost annually on downtown streets
    - An additional 1.7 million hours of lost time for bus passengers
    - Congestion losses are more severe (on a per passenger basis) for bus riders, a dynamic that feeds further congestion by disadvantaging public transit
- These losses decrease the attractiveness of locating a business in downtown Philadelphia, serving as a limiter on the city's growth

This analysis relies on anonymized auto travel data from INRIX, car volume estimates from DRVPC, and time-stamped bus data from SEPTA's Automated Passenger Counters (APC).

Car Congestion Delays on Downtown Streets

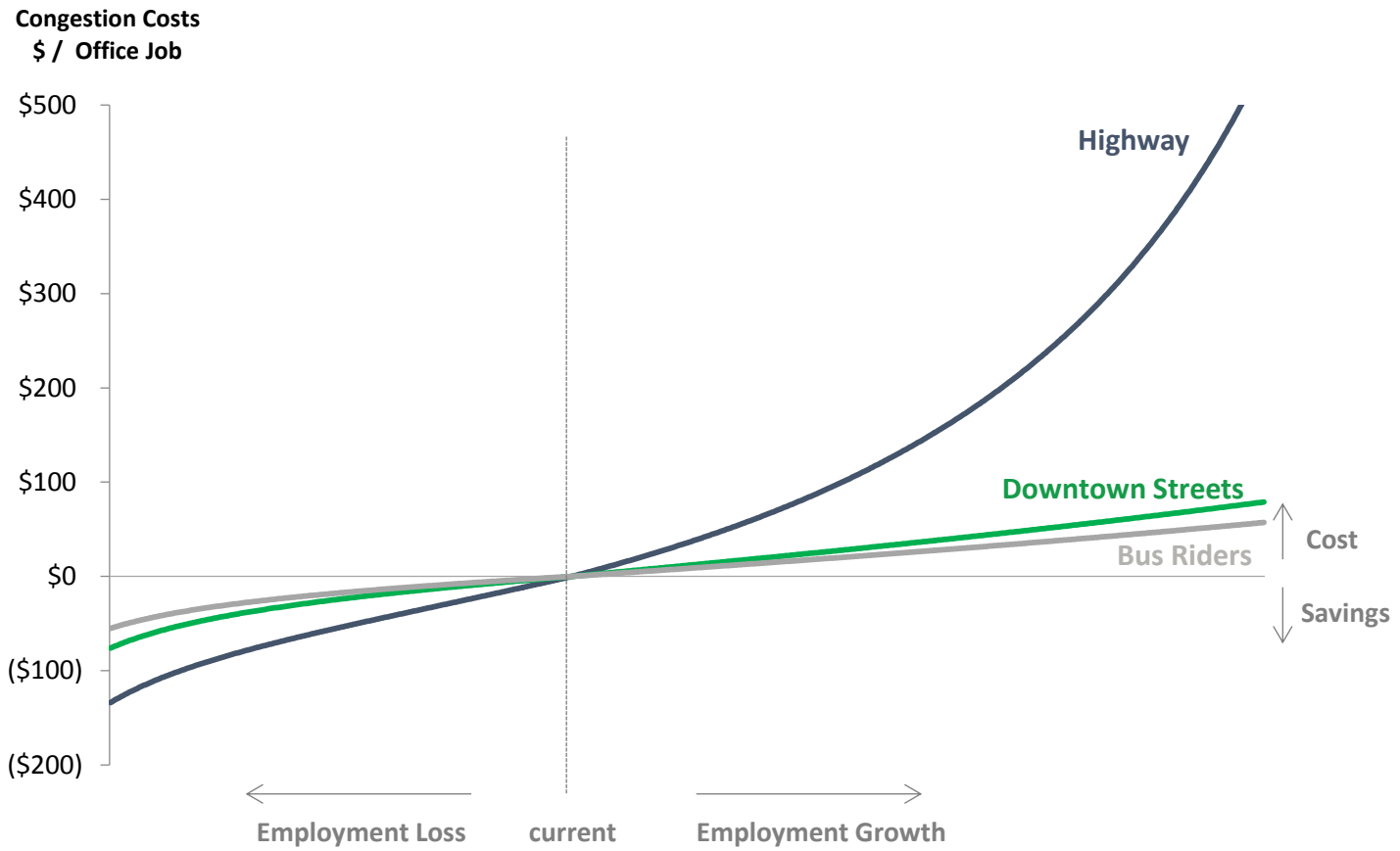


Congestion Costs from Employment Growth

- While employment growth increases productivity, additional workers increase congestion costs
- Three elements of congestion were modeled relative to downtown employment levels (based on current transportation infrastructure):
  - Highway (based on the observed speed / volumes on I-76 East, extrapolated to the city's highway network)
  - Downtown Streets (based on the observed speed / volumes in Center City)
  - Bus Riders (based on the observed relationship between car and bus congestion in Center City)
- Congestion costs are most acute on the highway
  - Highway congestion also accelerates most rapidly with employment growth

Key data sources for congestion modeling include:
DVRPC (highway data, highway and street volume counts)
Google Maps (highway travel time data)
INRIX (car travel time by street segment)
SEPTA APC (bus travel time by street segment)

Annual Congestion Costs per Downtown Office Worker

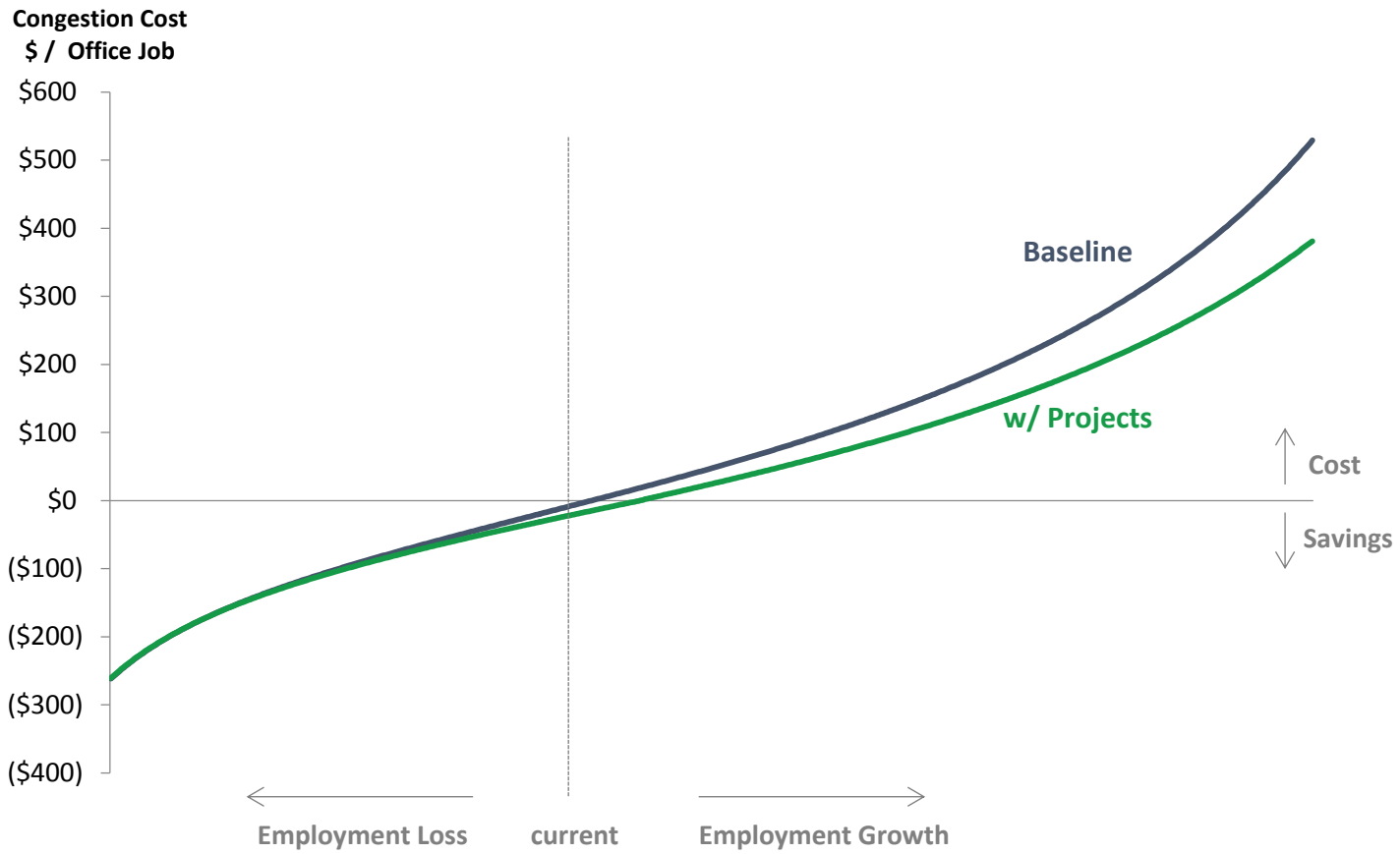


Impacts of Capacity Increases from Projects

- SEPTA's planned projects will significantly increase the peak carrying capacity into downtown Philadelphia
    - Combined peak capacity increase of 28% from MFL, Trolley and Regional Rail projects
- Capacity increases from the project allow the downtown market to absorb additional jobs before bearing congestion costs
    - Potential drivers are absorbed by non-congestible rail modes before spilling onto the highway / streets
- As the downtown market grows, the congestion cost curve shifts down and to the right
    - The projects significantly lower congestion costs at any given level of employment

Throughout this report, the "baseline" scenario projects future growth with a continuation of current transportation infrastructure. Notably, while no cost is attributed to this scenario, significant investment would be required over the long-term to maintain the current network even absent any expansion.

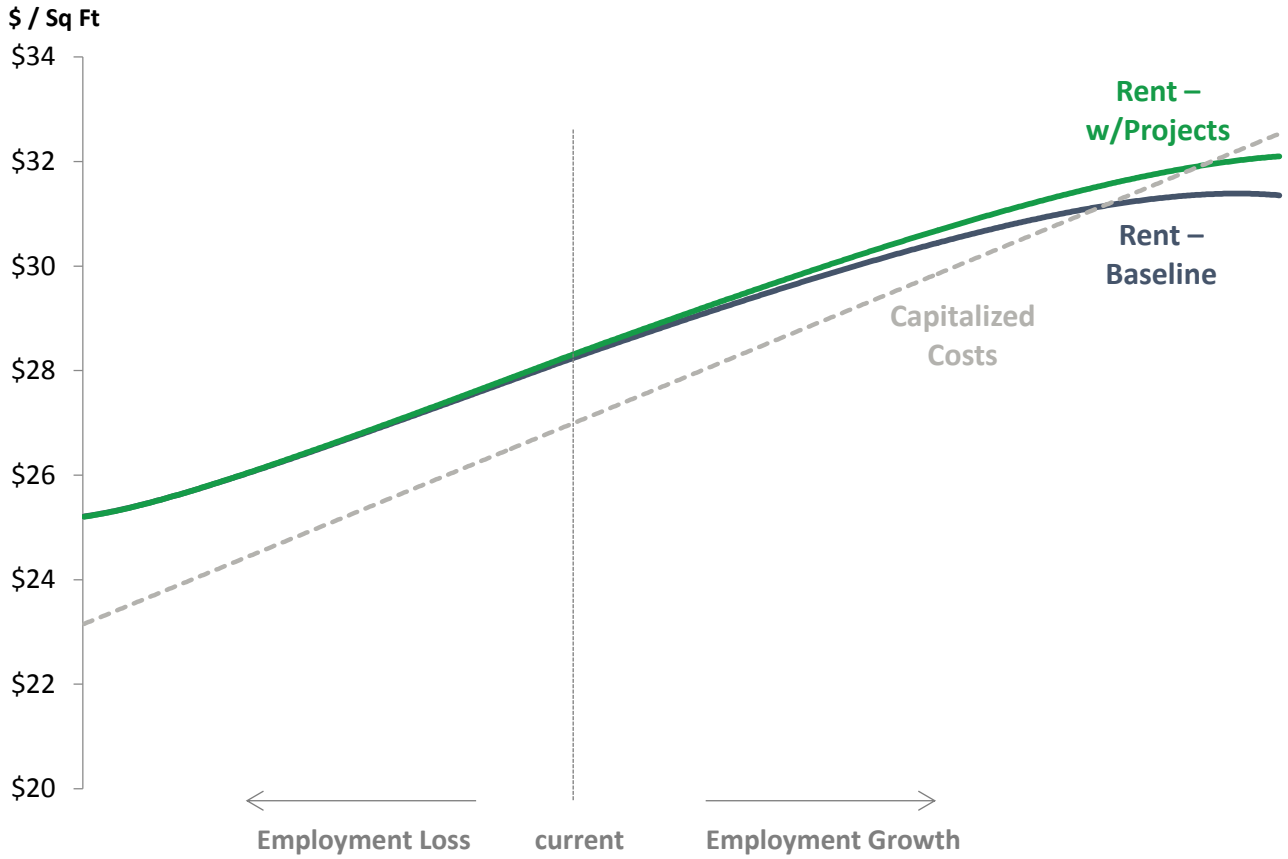
Reduction in Congestion Cost from Projects



Downtown Office Revenues and Costs

- As employment and density grow, agglomeration benefits increase attractiveness while congestion costs decrease attractiveness
    - The relative magnitude of these counteracting forces determine the change in rents per square foot
- Construction and operating costs increase with density and productivity, reducing profitability per square foot
- The reductions in congestion costs yielded by SEPTA's planned projects improve development profitability as employment density grows (as reflected in higher projected rents)

Revenue vs. Capitalized Cost for Downtown Office

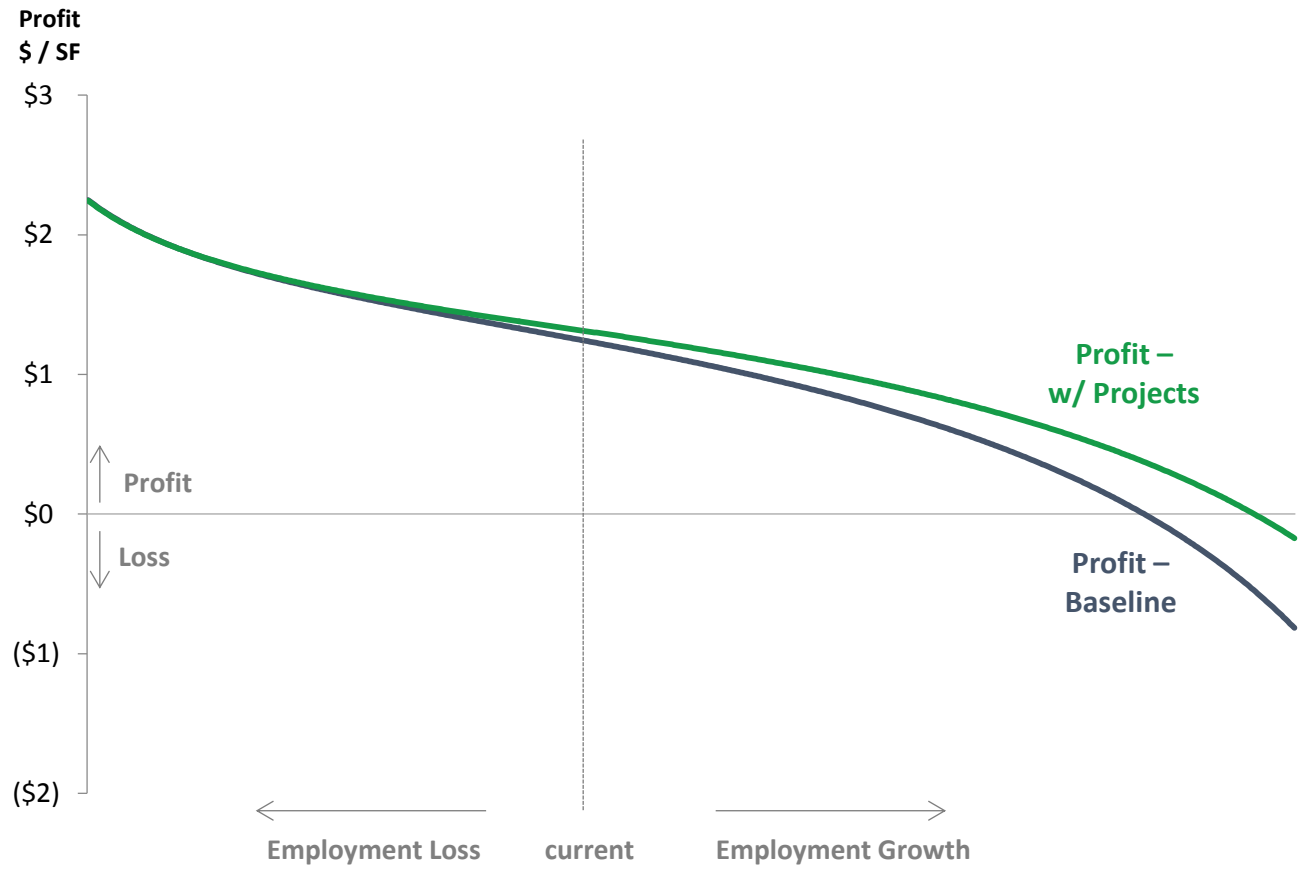


Note that site-specific zoning was not considered to be a constraint on the potential employment density of the downtown area as a whole, thought it could act as a constraint for any given location

Expected Development Profit

- The interaction of revenues and costs determines profitability per square foot at any level of employment / density
- Congestion mitigation from the projects helps maintain profitability (despite rising costs) as downtown employment grows

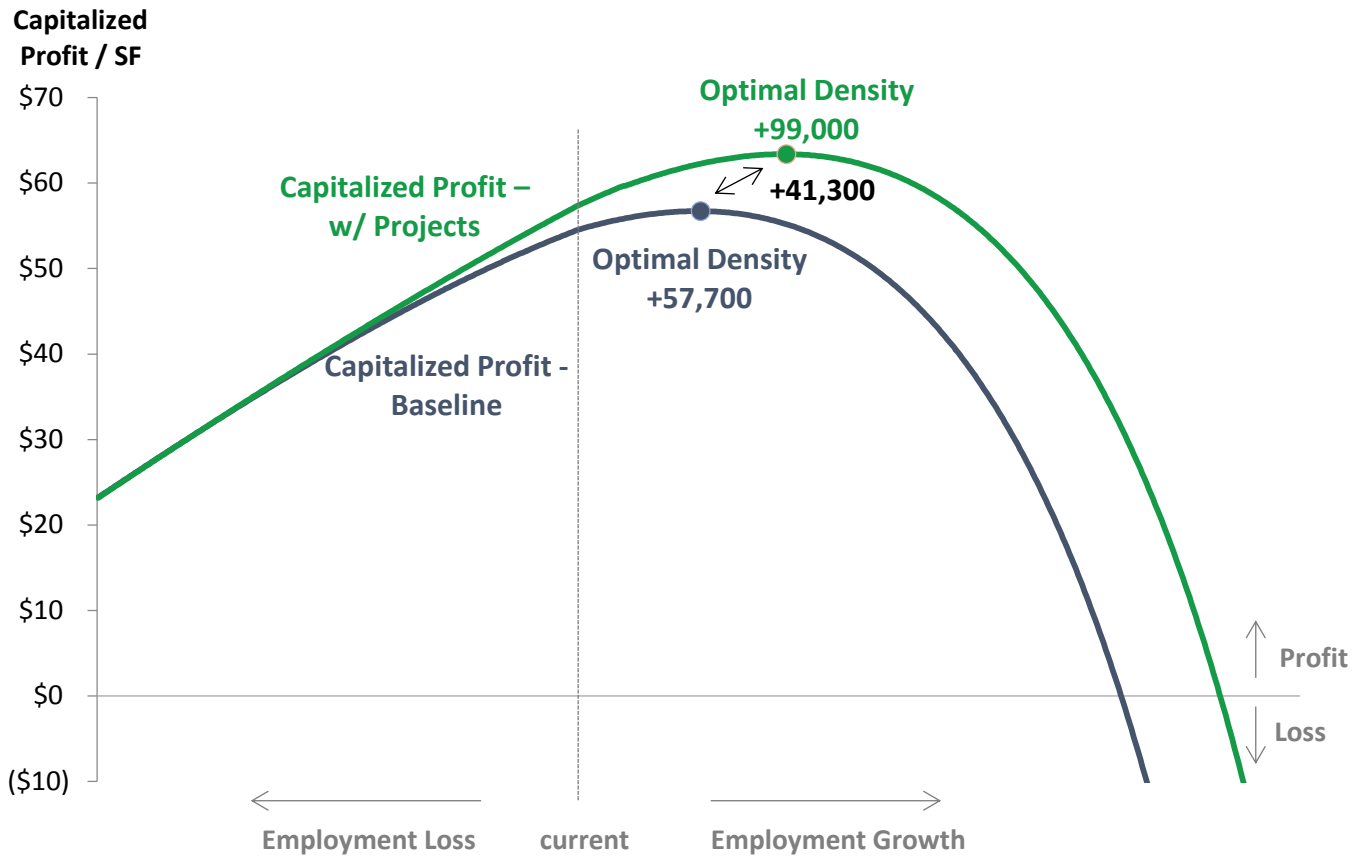
Change in Development Profit from Projects



Optimal Density Level

- Total capitalized profit combines the expected profit per square foot with building height, maximizing total profit and therefore land value
- The total profit curve arcs to a high point that defines the “optimal density,” after which additional costs do not justify the returns
- SEPTA’s projects push the optimal density point for downtown Philadelphia to the right
    - The optimal long-term employment level for downtown Philadelphia with the projects is estimated at 412,000, an increase of 99,000 over the current level
    - With current infrastructure, optimal downtown employment is estimated at 370,500, growth of 57,700 from the current level
    - The projects are therefore projected to increase downtown employment by 41,300 jobs

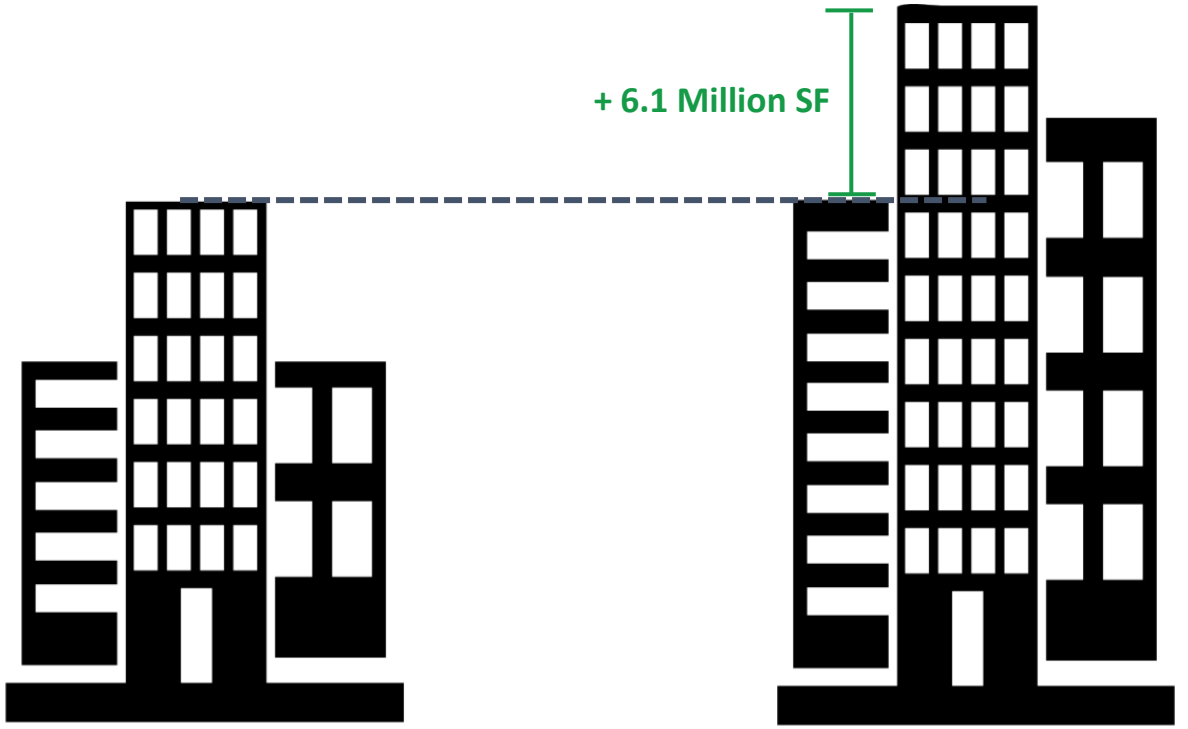
Optimal Density for Downtown Philadelphia



Office Market Development

- The optimal density projections imply different rates of growth in office market development from the current level of 45.7 million square feet
    - With current infrastructure, the downtown market is anticipated to add 8.4 million square feet of office space
    - With the projects, that forecast increases to 14.5 million square feet, a differential of 6.1 million
- Absent additional transit capacity, key development sites like Schuylkill Yards and uCity Square will fall short of their potential – or crowd out other growth in the office market

Additional Square Feet of Downtown Office Development



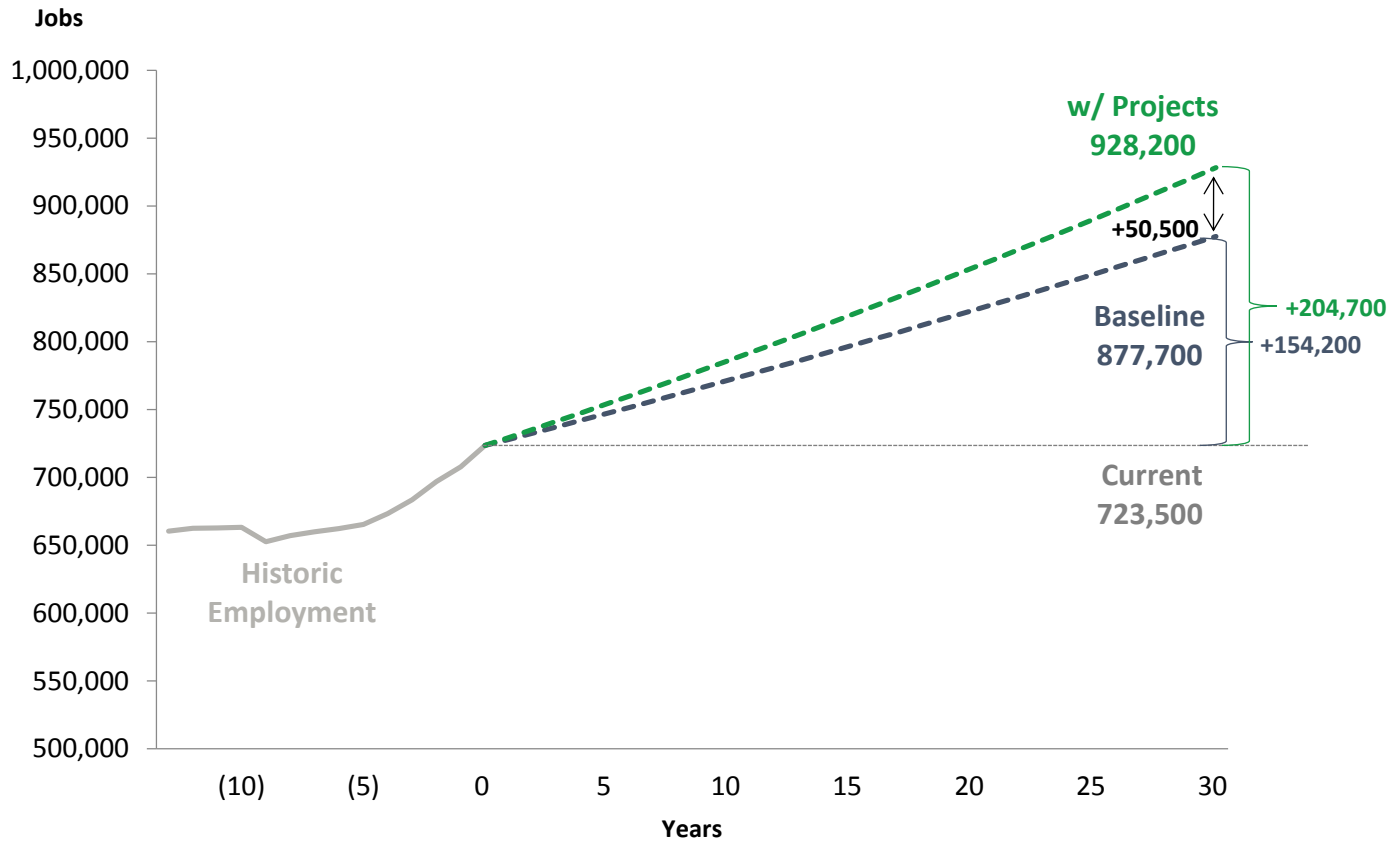
Baseline Growth Forecast
8.4 Million SF

Growth Forecast w/Projects
14.5 Million SF

Philadelphia Employment Growth

- Growth in downtown office employment creates spillover benefits into other sectors and areas of the city, yielding further increases in citywide employment
- Citywide job growth is projected to continue in line with recent trends under the baseline scenario, and to accelerate with the projects
- Over a 30 year time horizon, this differential translates to 50,500 additional jobs
    - Baseline: 21% growth (0.65% CAG) = 5,100 jobs per year
    - Projects: 28% growth (0.83% CAG) = 6,800 jobs per year

City of Philadelphia Employment Growth Projects



King of Prussia Development

- In addition to downtown development, the KOP Rail Project will stimulate development in the region's largest suburban employment node
    - 5.3 million square feet of net new development in the area
    - 8,000 net new jobs and $636 million in additional annual earnings

King of Prussia Development Impacts

5.3 million
SF of net new development

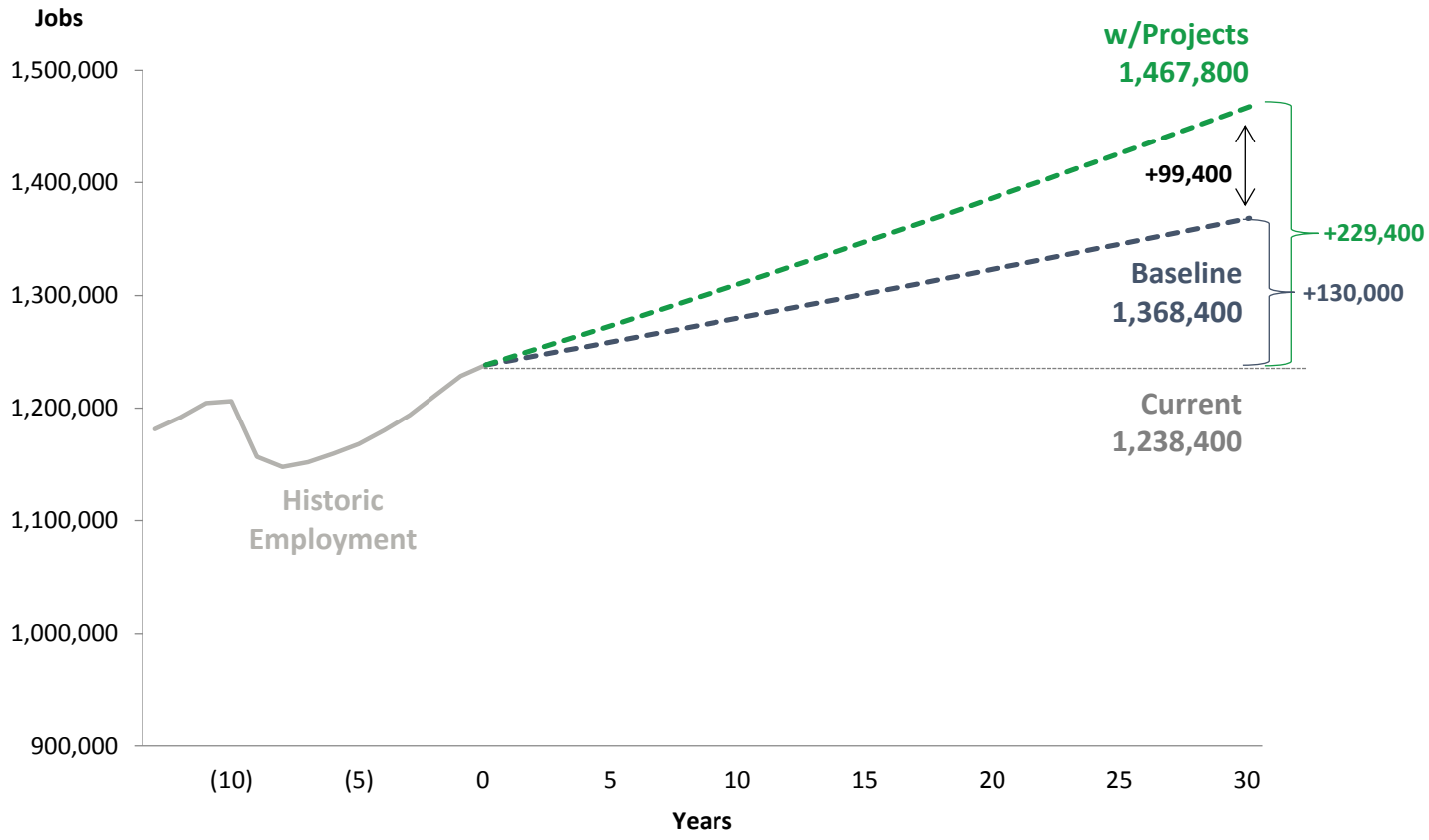
8,000
net new jobs

$636 million
additional annual earnings

Regional Employment Growth

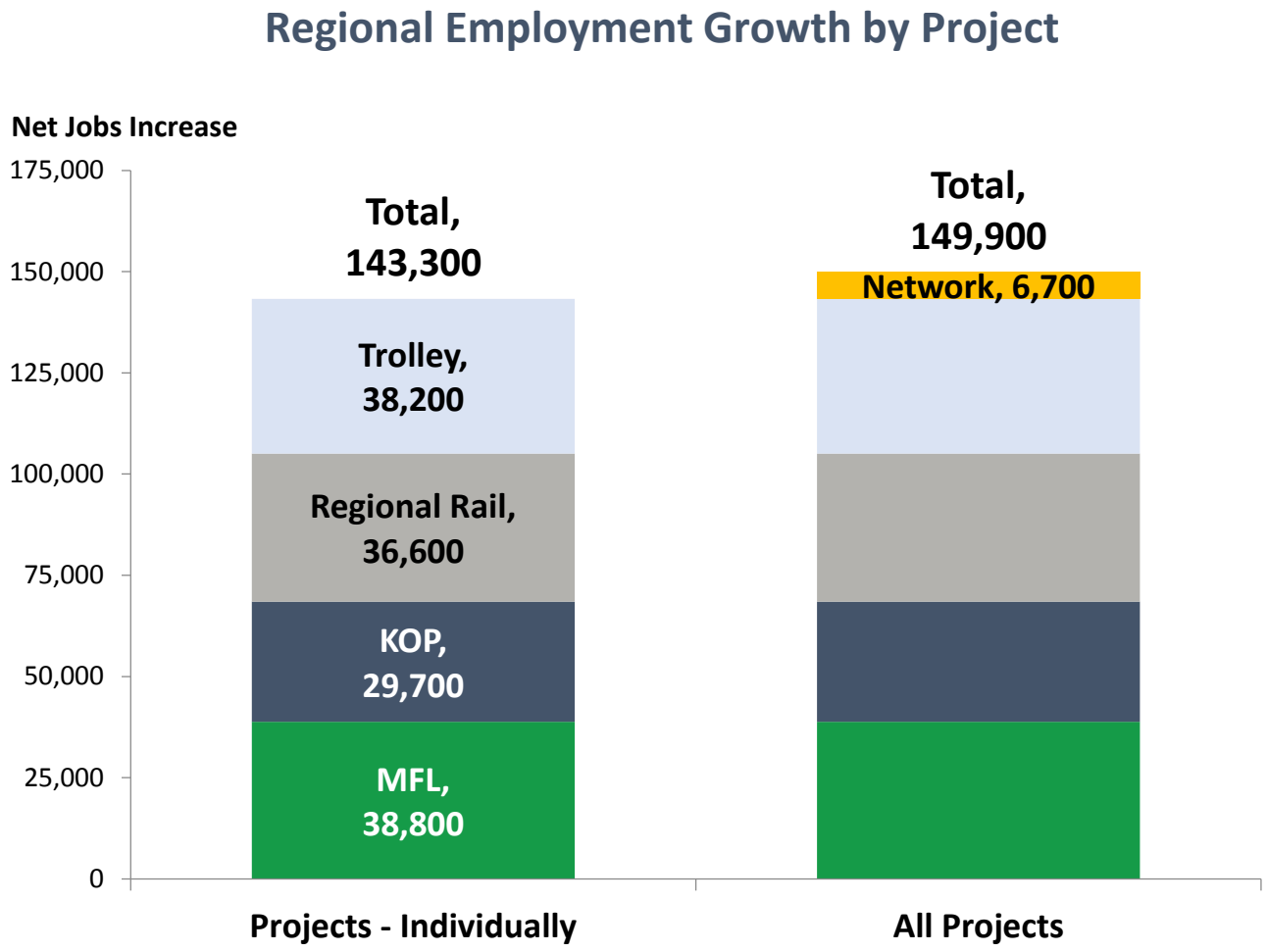
- The increased employment and attractiveness of the city driven by the projects will also enhance the competitiveness of the suburban employment market
- The historic relationship between city employment growth and suburban property value is utilized to estimate the general “lift” in suburban activity from city gains driven by the project
    - This approach exploits the linkage between property values and the additional earnings required to sustain housing price increases
- These broad gains are combined with localized growth projected in King of Prussia
- Over a 30 year time horizon, this growth differential translates to 99,400 additional suburban jobs
    - Baseline: 11% growth (0.33% CAG) = 4,300 jobs per year
    - Projects: 19% growth (0.57% CAG) = 7,600 jobs per year

Suburban Employment Growth Forecasts



Project Effects on Regional Employment Growth

- Incremental employment impacts can also be allocated to the individual projects by modeling each individually
    - Each projects produce similar magnitudes of regional employment increases
- The total catalytic impact of the projects is greater than the sum of each of the projects individually due to network effects and the non-linear effects of growth:
    - Congestion impacts increase as traffic volume grows (and losses accrue to more vehicles)
    - Agglomeration impacts yield productivity benefits that magnify initial growth
- The collective impact of the projects are estimated to produce 6,700 more jobs than the sum of individual project benefits



Regional Earnings Growth

- The projects also yield a significant increase in regional earnings
- Earnings growth is driven by both increases in the number of jobs and increases earnings per job (due to the productivity gains from the projects)

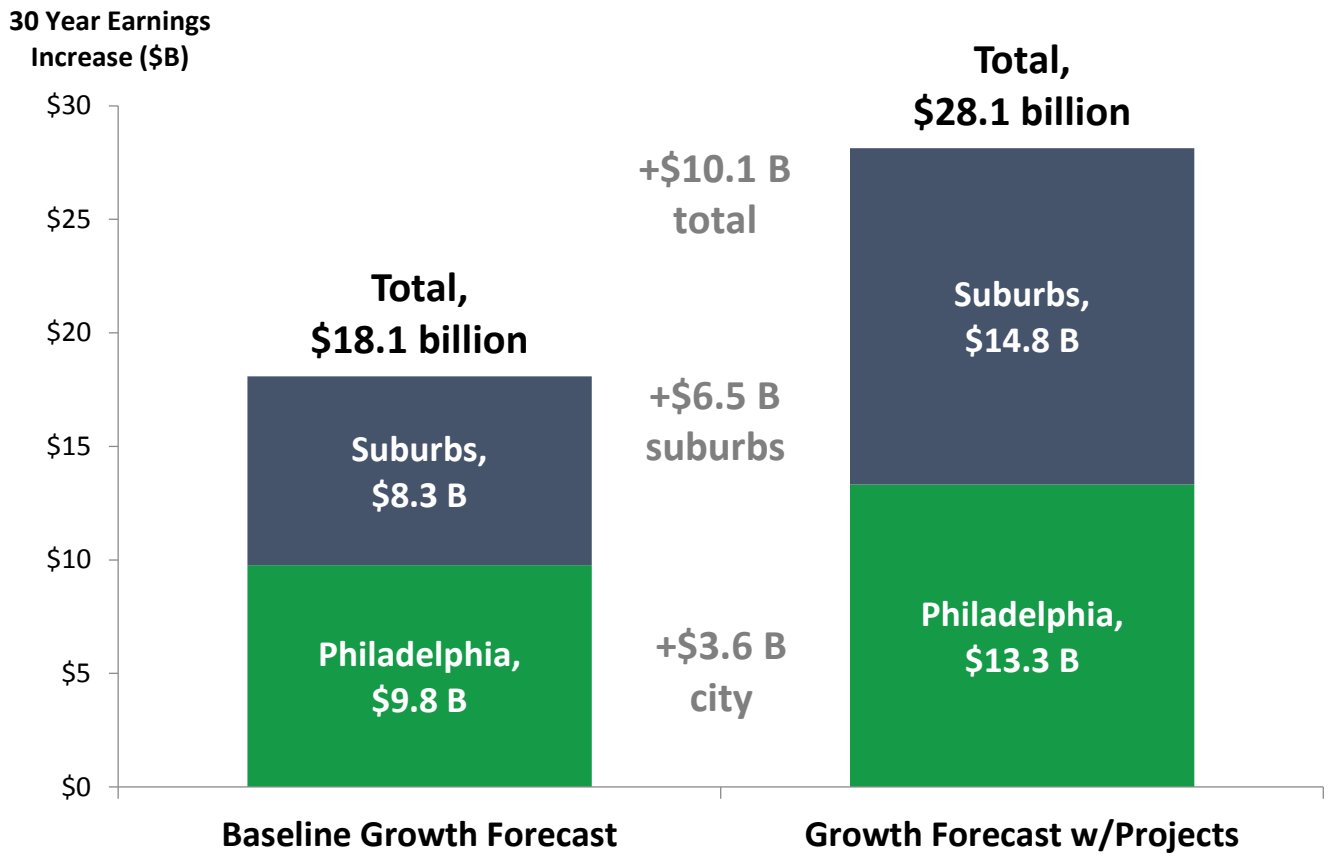
$3.6 billion
additional Philadelphia earnings

$6.5 billion
additional Suburban earnings

$10.1 billion
combined increase in earnings

Throughout this report, earnings, property values and tax revenues are expressed in constant dollar terms, excluding the effects of inflation

Regional Earnings Growth Forecasts



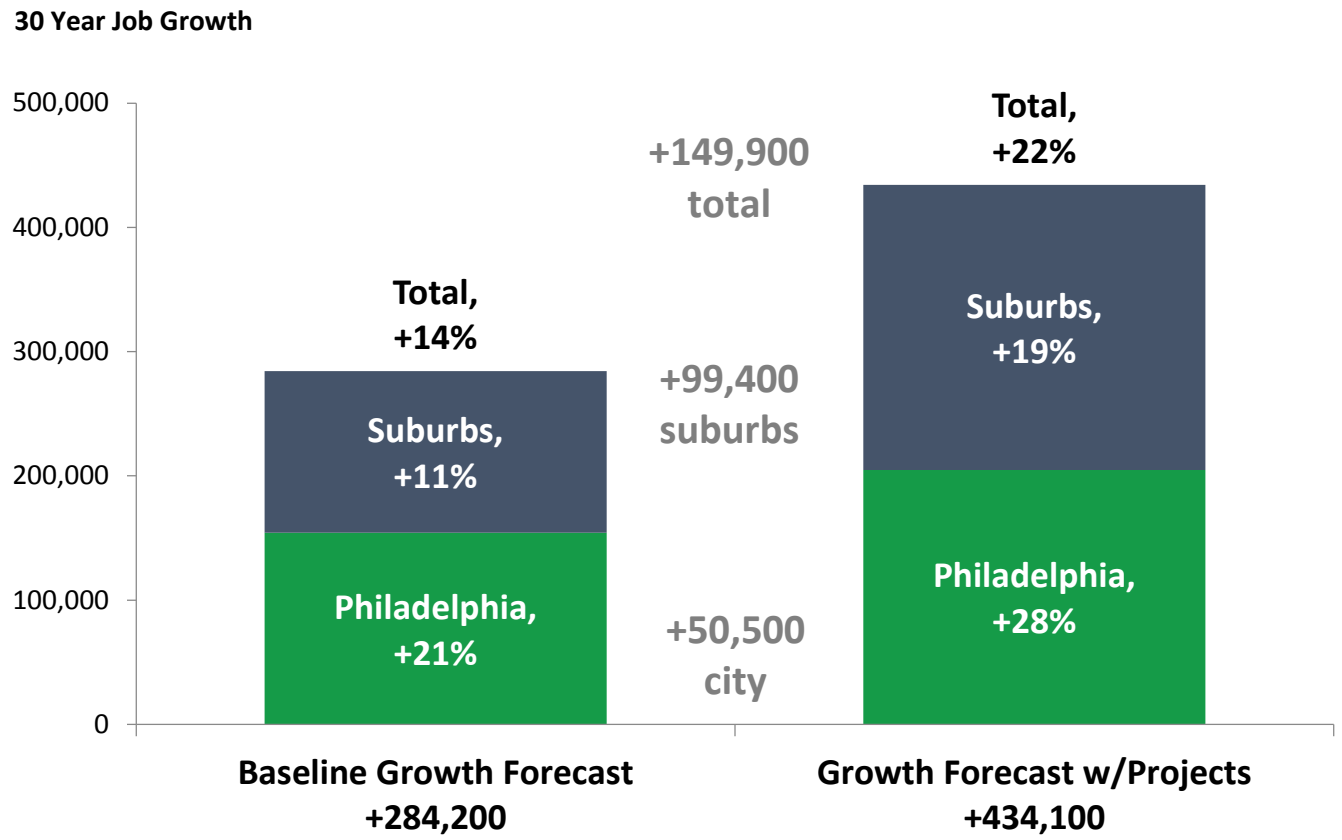
Employment and Development Impacts - Summary

11.4 million
SF of additional commercial development in downtown / KOP

149,900
additional jobs across the region

$10.1 billion
additional annual earnings across the region

Regional Employment Growth



Property Value Impact

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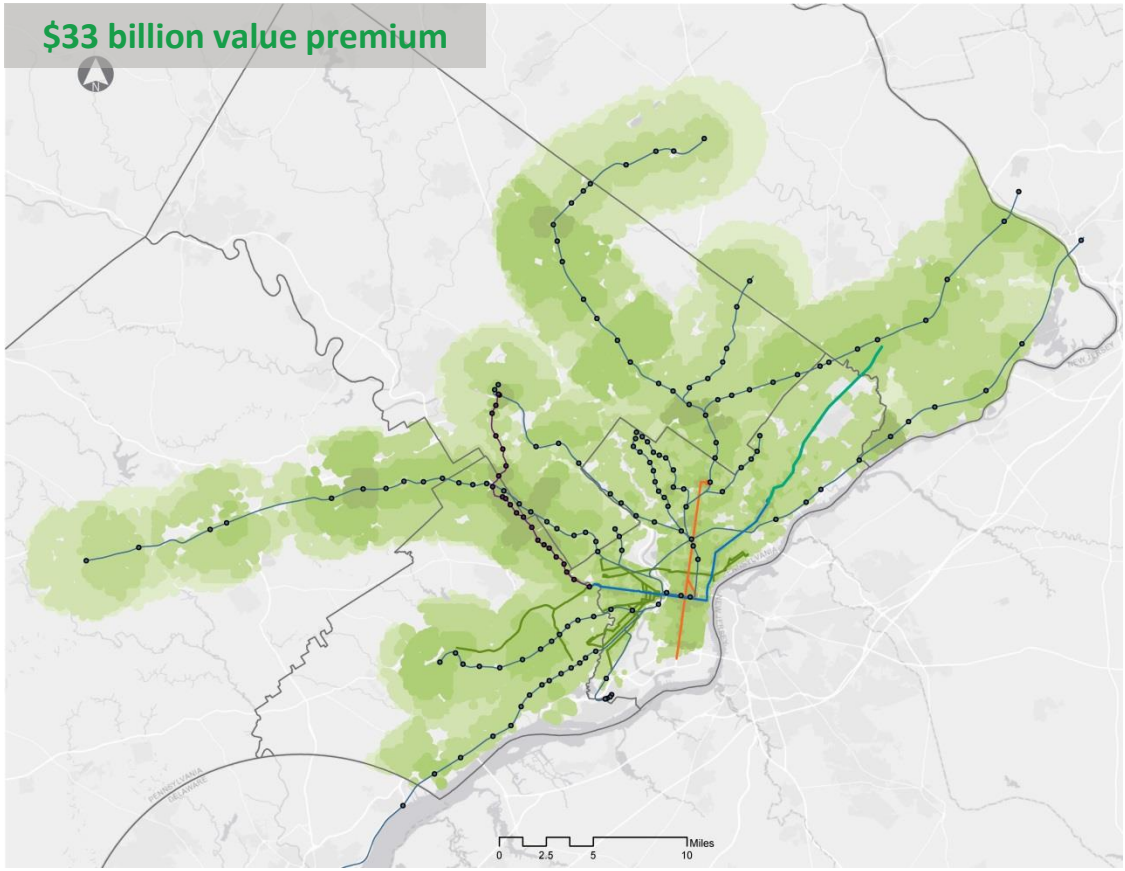
Property Value Premium from Transit Service

- Transit access is an amenity that increases property value for homeowners (whether or not they use the system)
- The value premium from transit service can be observed through housing market transactions
    - Hedonic regression analysis is a commonly used statistical technique that seeks to isolate the explanatory power of a single variable of interest (such as transit access), holding all other housing and neighborhood features constant
- ESI's has analyzed hundreds of thousands of arms-length housing transactions in Philadelphia and the suburban counties and estimated a total residential property value premium of $33 billion from existing SEPTA service throughout the region

For a searchable, interactive version of the property value map, visit septa.org/economic-impact

Property Value Premium from Existing SEPTA Service



Property Value Approach

- Improvements in service quality associated with the projects were translated into increases in property value for nearby houses based on observed relationships between distance transit quality and value premiums
    - Value from increased frequency and speed on Regional Rail, increased speed on Trolley, and new and more frequent service on the Norristown High Speed Line
- Improvements in destination quality associated with the projects were translated into housing value across the region based on observed relationships between employment growth and housing values
    - Value growth from downtown employment growth is highest for homes served by transit, but also accrues to housing that is not in proximity to SEPTA service
    - Gains from anticipated job growth in King of Prussia are modeled similarly

Contributions of Transportation Improvements to Property Value

Service Quality
Speed
Frequency
Rider Experience

Destination Quality
New Destination (KOP)
Enhanced Downtown Employment

Growth in regional employment hubs increases regional property values – including for housing that is not in proximity to SEPTA service

Residential Property Value Increase

- Existing houses in the city and region enjoy value premiums from improved service and improved destinations associated with the projects
    - Within the baseline scenario, housing values appreciate due to the (more modest) job growth, but do not see benefits from service improvements
- The projects are anticipated to generate a combined $9.4 billion in additional value for existing homeowners across the region
    - $2.9 billion in existing housing value growth within Philadelphia (value premium of 3.0%)
    - $6.5 billion in existing suburban housing value growth (value premium of 3.2%)

Notably, increases in housing costs associated with the premium from proximity to transit may be offset (in part or in total) by household savings on transportation expenditures. Prior ESI analysis indicates that the average household in Philadelphia enjoys a net financial benefit of $830 per year from the transportation and housing cost impacts of SEPTA service.

Value Increase from Projects for Existing Housing

$2.9 billion

Existing Philadelphia housing value growth

3.0% value premium

$6.5 billion

Existing suburban housing value growth

3.2% value premium

$9.4 billion

combined increase

Residential Property Value from New Housing

- In addition to growth in existing values, an increase in the pace of housing production is required to accommodate the additional job growth spurred by the projects
- New housing growth value growth is modeled as a function of the additional earnings for regional residents devoted to housing costs
  - Net of earnings leaking outside the region
  - Net of earnings contributing to existing housing value
- $9.4 billion in new housing value across the region is anticipated from the employment and associated population growth attributable to the projects
  - $3.7 billion in new housing value in Philadelphia
  - $5.7 billion in new housing value in the suburbs

Residential Property Value from New Housing

$3.7 billion
New Philadelphia housing value

$5.7 billion
New Suburban housing value

$9.4 billion
combined increase

Commercial Property Value

- Additional development and employment will also increase commercial property values, both from the value of additional square footage and increases in the underlying land value
- Increases in profitability and development in the downtown core from the projects generate an estimated $1.46 billion increase (11% growth) in the taxable assessed value
    - An adjustment is made in fiscal modeling to reflect that new development would be tax abated for some portion of the study time period
- Anticipated development at King of Prussia generates $260 million in additional commercial property value
- Additional commercial value in secondary markets throughout the region is not captured in this analysis
    - The significant increases in suburban employment necessarily imply additional commercial value increases

Commercial Property Value Growth (Downtown + KOP)

$1.46 billion
additional taxable downtown commercial value

11% downtown value premium

$260 million
in net new KOP commercial value

$1.72 billion
combined increase

Property Value Premium - Summary

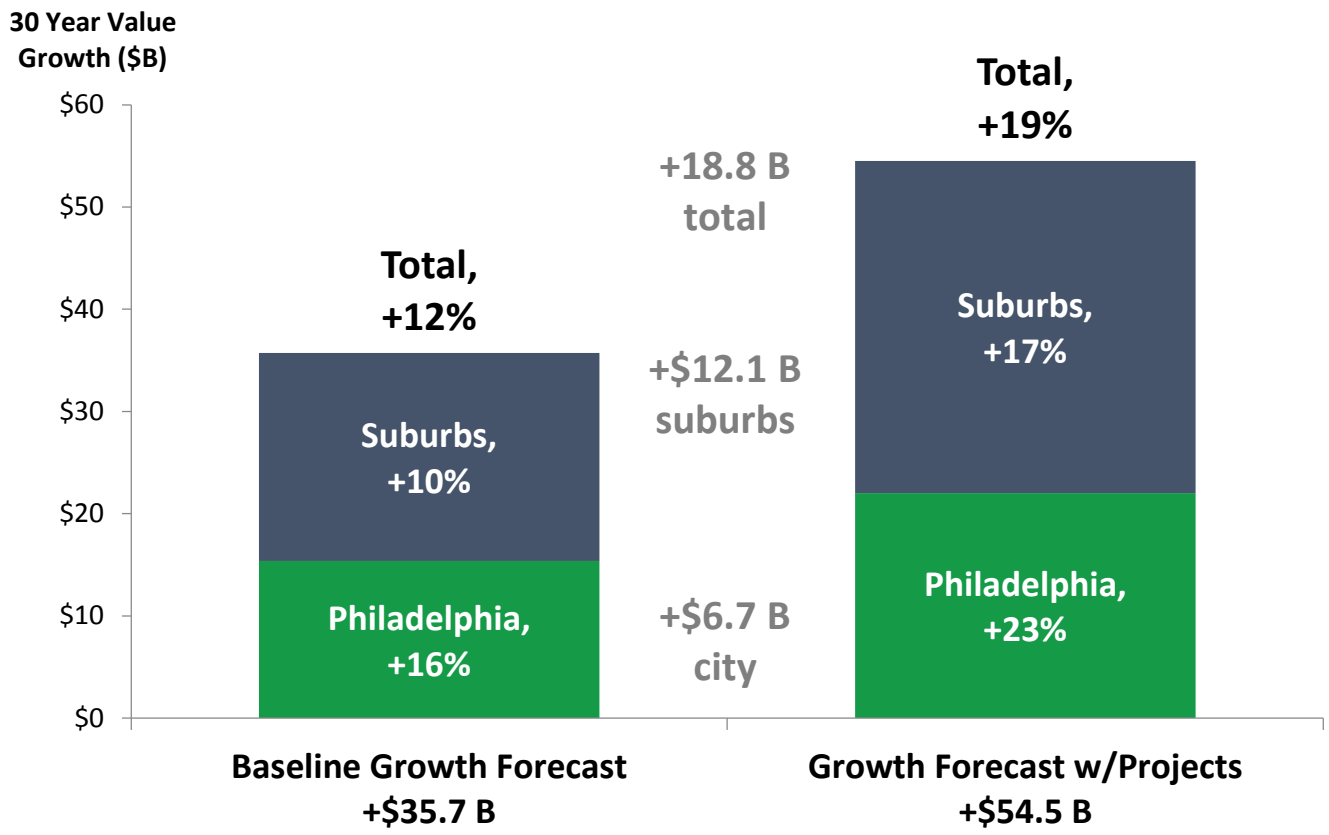
$9.4 billion
existing housing value growth

$9.4 billion
new housing value

$1.7 billion
additional commercial property value in downtown / KOP

$20.5 billion
total property value growth

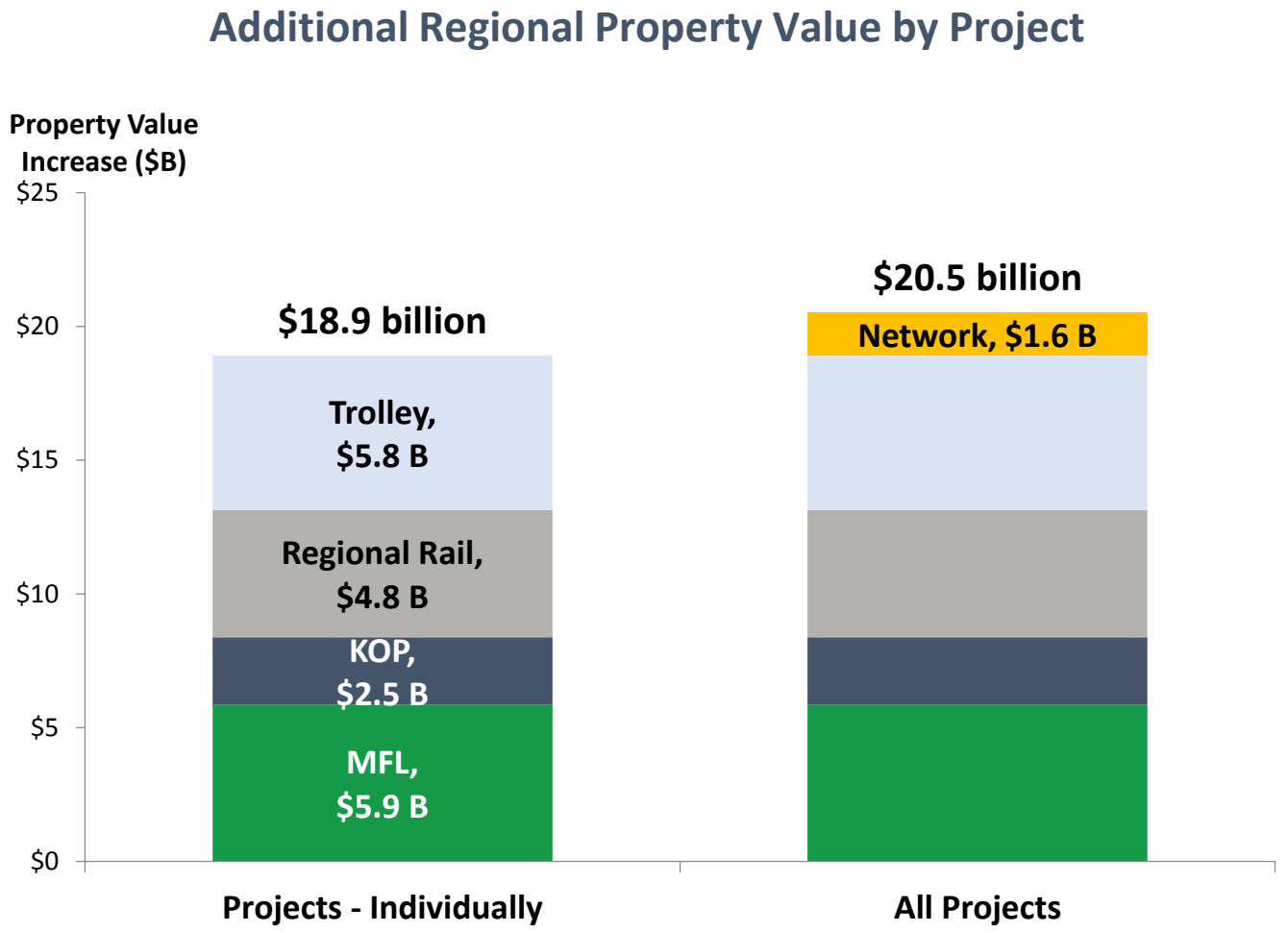
Residential Property Value Growth Projections



30 Year growth from existing and new housing in constant $

Project Effects on Regional Property Value

- Property value impacts are also modeled at the project level based on employment and service quality changes attributable to each project
- Projects that provide the greatest increases in capacity generate the highest property value impacts due to the relationship between city employment and value premiums throughout the region
- The collective impact of the projects is again greater than the sum of individual projects
    - An additional $1.6 billion in regional property value is generated by the network effects of the collective package of projects



Economic and Fiscal Impacts

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Tax Revenue Growth

- The additional economic activity and property value attributable to the projects generate revenue for state and city governments, as well as local municipalities and school districts
- Fiscal impacts are modeled based on the current relationships between tax collections and economic activity of various types (i.e. effective tax rates)
- Additional tax collections attributable to the projects (relative to the baseline) are estimated at $1 billion annually, comprised of:
    - $449 million in Pennsylvania taxes (Income, Sales, Corporate Net Income, Real Estate Transfer)
    - $277 million in Philadelphia city and school district taxes (Wage, Sales, Business, Property, Real Estate Transfer)
    - $277 million in suburban municipality, county and school district taxes (Earned Income, Property, Real Estate Transfer)

Annual Tax Revenue Increase from Projects

Tax Type ($Millions)	Total	Pennsylvania	Philadelphia	Suburbs
Income / Sales / Business	$633	$441	$161	$31
Property	$349		$108	$241
Real Estate Transfer	$21	$8	$8	$5
Total	**$1.002 billion**	**$449 million**	**$277 million**	**$277 million**

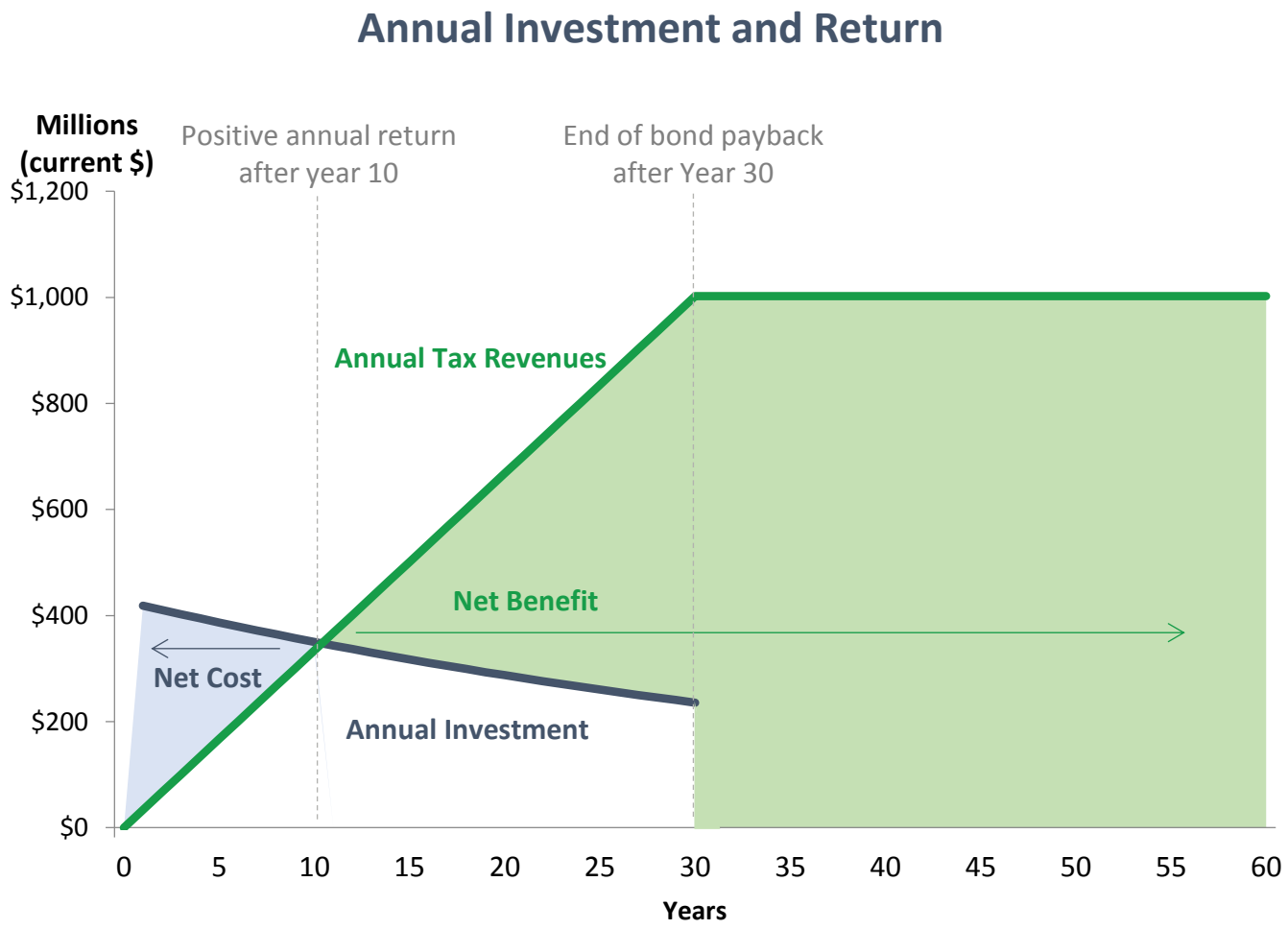
$1 billion

increased annual tax revenue for state and local government

Return on Investment

- Public investments in the projects are modeled as a fixed annual revenue stream to repay a bond issuance over a thirty year period
    - The real cost of this revenue stream declines over time due to inflation
- Tax revenues increase over the thirty year period, as economic activity and property values grow to the enhanced equilibrium level
    - Projects will generate a positive annual return (with additional revenues relative to the baseline scenario higher than payback costs) after year 10
- Tax revenue benefits are ongoing beyond the 30 year payback period, since they represent a base level of activity moving forward

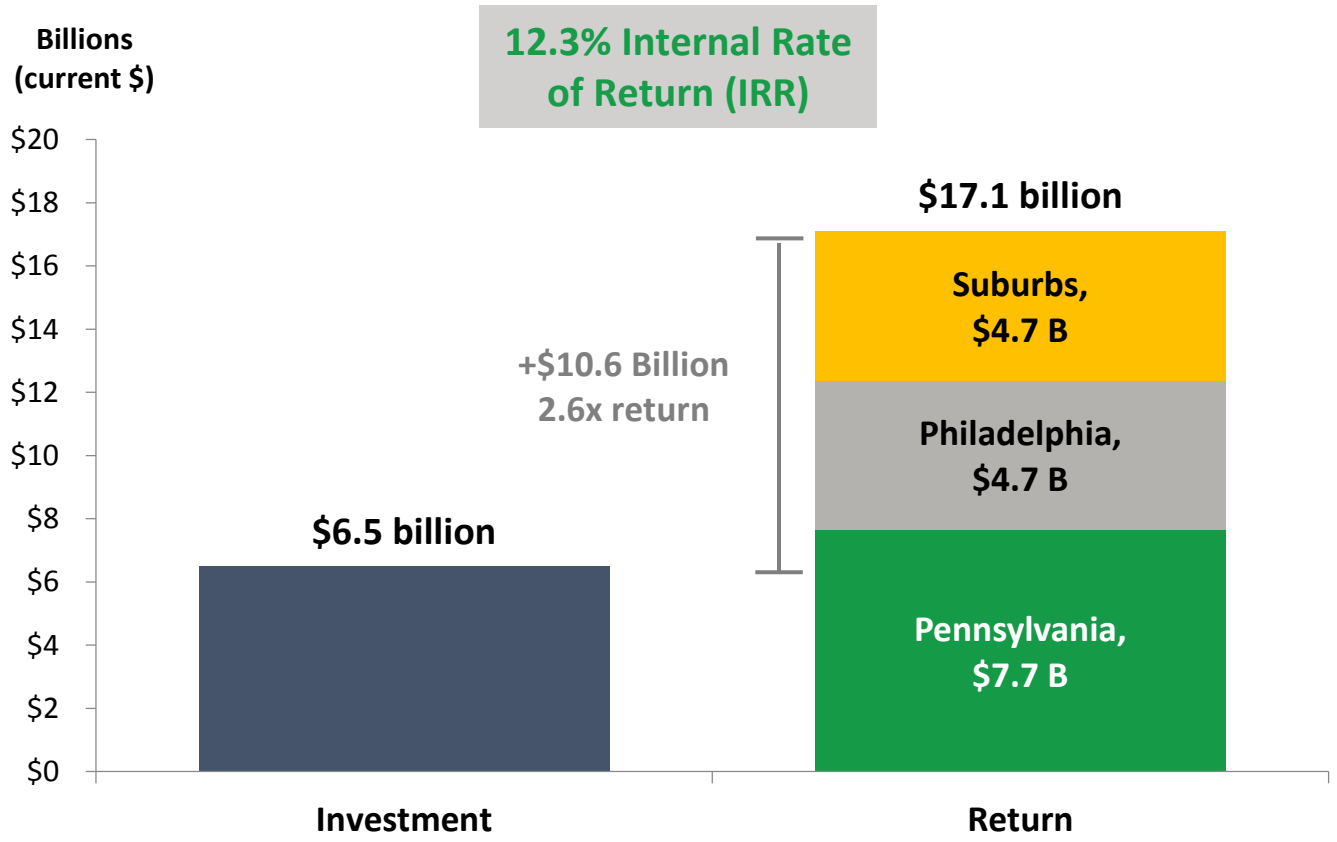
Tax revenue growth is modeled to phase in evenly (in constant dollar terms) across the 30 year projection period



Public Return on Investment

- A Net Present Value (NPV) framework is used to directly compare the total public investment with the total return in additional tax revenues
    - The Net Present Value reflects the difference between expected investments and returns in a given year, adjusted for time value
    - A discount rate of 5% per year is used, matching a typical borrowing rate for bonds
- The projects generate an estimated $17.1 billion in NPV relative to an investment of $6.5 billion, a return multiple of 2.6x
    - This translates to an annual return of 12.3%, which exceeds private sector investment benchmarks (such as average stock market returns)
- The largest tax revenue return is for Pennsylvania, which accrues values from both city and suburban activity

Net Present Value of Investment and Return

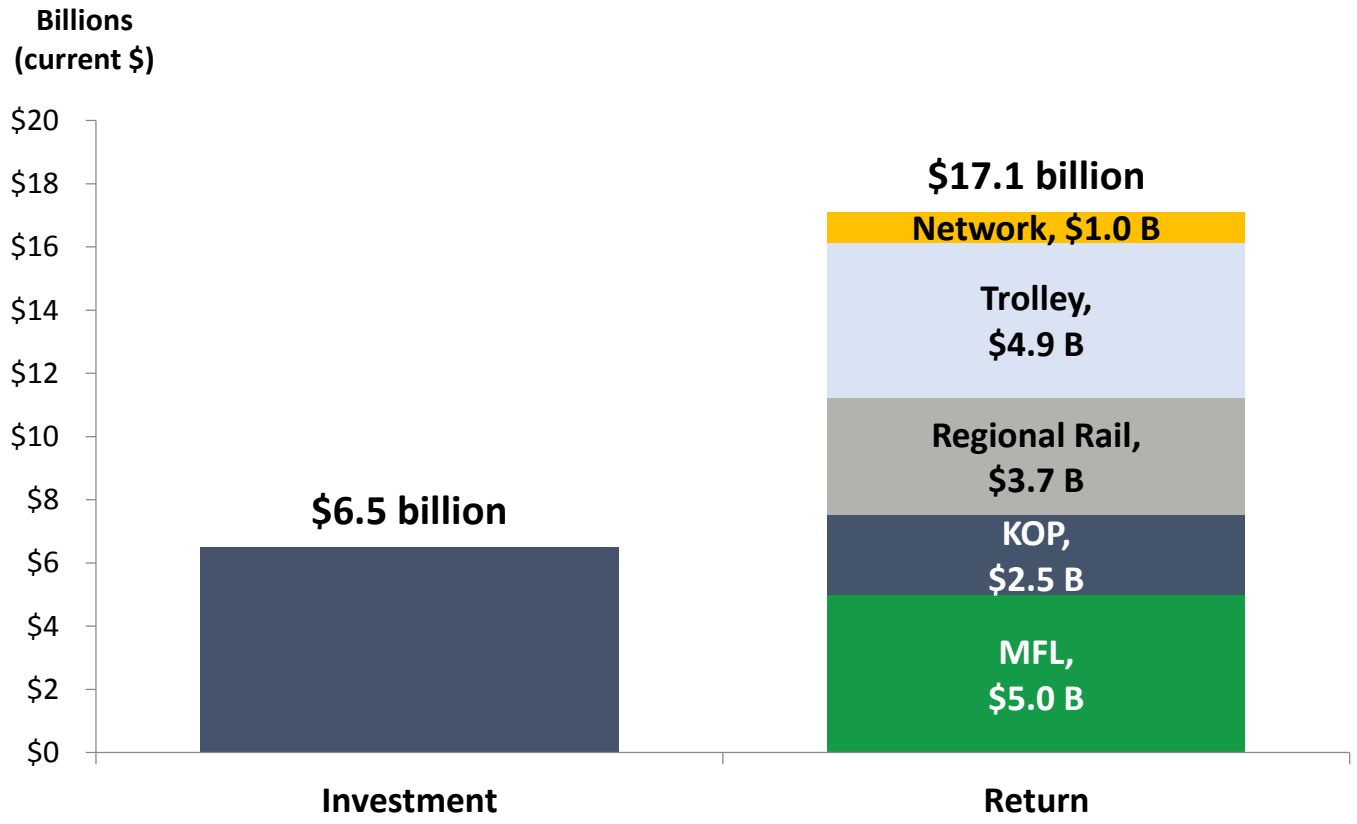


Net Present Value of expected costs and tax revenues over 60 years at a 5% discount rate

Project Return on Investment

- Returns can also be calculated on a project level, based on the employment and property value impacts attributable to each project
- Public revenue returns are well in excess of anticipated costs for each project
- Network effects from the package of the projects are anticipated to generate $1 billion in public revenues

Net Present Value of Return by Project



Net Present Value of expected costs and tax revenues over 60 years at a 5% discount rate

Key Takeaways

- **The projects of significance yield a strong return on investment**
  - The 12.3% annual return exceeds private sector investment benchmarks (such as stock market returns)
  - Returns are ongoing rather than one-time, changing the development economics and growth path of the region
- **The package of projects is greater than the sum of its parts**
  - The return of the projects collectively is $1 billion higher than the sum of the projects individually
  - The projects are varied in their contributions, with some (MFL / Trolley) contributing more to downtown development activity and others (Regional Rail / KOP) more to suburban property value
- **The valuation framework is very conservative**
  - Returns are evaluated compared to a baseline of continued existing service, and exceed the project cost of $6.5B
  - In practice, a significant portion of the project investment is required to maintaining existing service over the long-term
  - The project ROI would be significantly higher if considering only the incremental cost of capacity enhancement / service improvement elements of the projects (above and beyond fleet replacement)